Abstract: Among patients on dialysis, cardiovascular disease and infection are leading causes of hospitalization and death. Although recent studies have found that the risk of cardiovascular events is higher after an infection-related hospitalization, studies have not fully elucidated how the risk of cardiovascular events changes over time for patients on dialysis. In this work, we characterize the dynamics of cardiovascular event risk trajectories for patients on dialysis via multiple time indices: (1) time since the start of dialysis, (2) time since the pivotal initial infection-related hospitalization, and (3) the patient's age at the start of dialysis, by developing generalized multiple-index varying coefficient (GM-IVC) models. The proposed GM-IVC models utilize a multiplicative structure and one-dimensional varying coefficient functions along each time and age index to capture the cardiovascular risk dynamics before and after the initial infection-related hospitalization. We develop a two-step estimation procedure for the GM-IVC models based on local maximum likelihood. We report new insights on the dynamics of cardiovascular events risk using the United States Renal Data System database, which collects data on nearly all patients with end-stage renal disease in the U.S.